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24 May 2010
SUPERSEDING
MIL-PRF-71208 (AR)
9 April 2001

PERFORMANCE SPECIFICATION

CARTRIDGE, 5.56MM, ARMOR PIERCING - M995

This specification is approved for use by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification describes the performance requirements and verification methods for the Cartridge, 5.56mm, Armor Piercing (AP), M995 (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 4 of this specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

Comments, suggestions, or questions on this document should be addressed to: Commander, US Army ARDEC, ATTN: RDAR-QES-E, Picatinny Arsenal, New Jersey 07806-5000 or emailed to ardecstdzn@conus.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

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DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-372	Cleaning Compound, Solvent (For Bore of Small Arms and Automatic Aircraft Weapons)
MIL-PRF-680	Degreasing Solvent
MIL-DTL-12468	Decontaminating Agent, STB
MIL-DTL-12560	Armor Plate, Steel, Wrought, Homogeneous (for Use in Combat-Vehicles and for Ammunition Testing)
MIL-PRF-14107	Lubricating Oil, Weapons, Low Temperature
MIL-L-46000	Lubricant, Semi-Fluid (Automatic Weapons)
MIL-DTL-46177	Armor Steel Plate and Sheet, Wrought, Homogeneous
MIL-PRF-63460	Lubricant, Cleaner and Preservative for Weapons and Weapon Systems
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-286	Propellants, Solid: Sampling, Examination and Testing
MIL-STD-636	Visual Inspection Standards for Small Arms Ammunition through Caliber .50
MIL-STD-650	Explosive: Sampling, Inspection and Testing
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-1168	Ammunition Lot Numbering and Ammunition Data Card
MIL-STD-1916	DOD Preferred Methods for Acceptance of Product

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

U.S. ARMY ARDEC DRAWINGS

7643674	Classification of Cartridge Case Defects
8648615	Gage, Receiver, Profile and Alignment, 5.56mm Cartridge
10520006	Ball, 3.94 Oz
10524139	Pin, Firing, 5.56mm
11691287	Link, Cartridge, Metallic Belt, 5.56mm, M27
12590217	Packing and Marking For Wirebound Box For PA108 Ammunition Container
12956131	Cartridge, 5.56mm, Armor Piercing, M995

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(Copies of these drawings are available from U.S. Army ARDEC, ATTN: RDAR-EIS-PE, Picatinny Arsenal, NJ 07806-5000), or email: Pica.Drawing.Request@conus.army.mil.)

ARDEC PUBLICATIONS

SCATP-5.56mm (Heavy Bullet)	Small Caliber Ammunition Test Procedures for 5.56mm Heavy Bullet Cartridges

(Application for copies should be addressed to Quality Engineering and Systems Assurance, U.S. Army, ARDEC, Picatinny Arsenal, NJ 07806-5000, ATTN: RDAR-QEM-D or email PicaQEM-D@conus.army.mil.)

DEPARTMENT OF DEFENSE TECHNICAL BULLETIN

TB-700-2	Department of Defense Ammunition and Explosives Hazard Classification Procedures

(This document is available online at https://www3.dac.army.mil/es/documents/TB700_2.pdf, or from the DoD Explosives Safety Board, Room 856C, Hoffman Building 1, 2461 Eisenhower Avenue, Alexandria, VA 22331-0600.)

US ARMY DEVELOPMENT TEST COMMAND

INTERNATIONAL TEST OPERATIONS PROCEDURE (ITOP)

ITOP 1-2-601	Laboratory Vibration Schedule
ITOP 4-2-601	Drop Tower Tests for Munitions
ITOP 4-2-602	Rough Handling Tests

TEST OPERATING PROCEDURE (TOP)

TOP 1-2-608	Sound Level Measurements
TOP 2-2-614	Toxic Hazards Tests for Vehicles and Other Equipment
TOP 3-2-045	Automatic Weapons, Machine Guns, Hand and Shoulder Weapons
TOP 4-2-604	Range Firing of Small Arms Ammunition
TOP 4-2-827	Time of Flight and Ballistic Coefficient

(Copies of these documents may be ordered from the US Army Developmental Test Command, ATTN: Publications, 314 Longs Corner Road, Aberdeen Proving Ground, MD 21005-5005, or online at http://www.dtc.army.mil/publications/topsindex.aspx.)

NAVAL SURFACE WARFARE CENTER INSTRUCTIONS

NAVSEAINST 8020.19	Instruction for Electrostatic Discharge (ESD) Safety Program

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(Request for copies should be addressed to: Commander Indian Head Division, Naval Surface Warfare Center, 101 Strauss Avenue Code 660, Indian Head, MD 20640-5035.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM D1141 Standard Practice for the Preparation of Substitute Ocean Water

(Copies may be ordered from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, http://www.astm.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Design verification. When specified (see 6.2), a sample of the cartridges shall be subjected to design verification test inspection in accordance with 4.1, and Tables I, II, V and VI.

3.1.1 Key characteristics. Key characteristics of the design for which uniformity is deemed essential to meet performance requirements shall be identified, and the allowable variability shall be established during design verification. The variability of key characteristics shall thereafter conform to these established values.

3.2 First article. When specified (see 6.2), a sample of the cartridges shall be subjected to first article inspection in accordance with 4.2, and Tables I, III, V and VI.

3.3 Conformance verification. When specified (see 6.2), a sample of the cartridges shall be subjected to conformance verification in accordance with 4.3, and Tables I, IV, V and VI.

3.4 Interface and interoperability requirements.

3.4.1 Interface with link. The cartridge shall interface with the M27 link.

3.4.2 Physical dimensions. The cartridge dimensions shall conform to Drawing No. 12956131.

3.4.3 Head stamp. The cartridge case head shall be stamped with the initials of the manufacturer or recognized trade name, and the last two numbers of the year of manufacture.

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3.5 Operating requirements.

3.5.1 Primer sensitivity. The value of the average height (h) and standard deviation (s) of the height of fire, functioning by a 3.94 ± .02 ounce steel ball, shall be such that h + 3s shall be not greater than 12 inches (30.48 cm) and h – 3s shall be not less than 3 inches (7.62 cm).

3.5.2 Chamber pressure.

3.5.2.1 Chamber pressure at 70ºF. The average chamber pressure of cartridges, conditioned at 70°F ± 2ºF (21°C ± 1.1°C), shall be not greater than 59,700 psi (411.6 MPa). Neither the chamber pressure of an individual cartridge nor the average chamber pressure plus three standard deviations of chamber pressure shall be greater than 64,700 psi (446.1 MPa).

3.5.2.2 Chamber pressure at extreme temperatures. The average chamber pressure of cartridges conditioned at -65°F ± 2ºF (-54°C ± 1.1°C) and at 125°F ± 2ºF (52°C ± 1.1°C) shall not vary from the average chamber pressure of cartridges conditioned at 70°F ± 2ºF (21°C ± 1.1°C) by more than 7,000 psi (48.3 MPa), and shall be not greater than 64,700 psi (446.1 MPa).

3.5.3 Port pressure.

3.5.3.1 Port pressure at 70ºF. The mean port pressure minus three standard deviations shall be not less than 15,300 psi (105.5 MPa) for cartridges conditioned at 70°F ± 2°F (21°C ± 1.1°C).

3.5.3.2 Port pressure at extreme temperatures. The average port pressure of the cartridges conditioned at -65°F ± 2°F (-54°C ± 1.1°C) and at 125°F ± 2°F (52°C ± 1.1°C) shall not vary by more than 2,000 psi (13.8 MPa) from the average port pressure of the sample test cartridges conditioned at 70°F ± 2°F (21°C ± 1.1°C), and shall be not less than 14,600 psi (100.7 MPa).

3.5.4 Velocity. The design velocity of the cartridge shall be established during design verification.

3.5.4.1 Velocity at 70ºF. The mean velocity of cartridges conditioned at 70°F ± 2°F (21°C ± 1.1°C), and measured at 78 ft (23.8 m) from the muzzle of the weapon, shall be within ± 40 ft/s (± 12.2 m/s) of the design velocity. The standard deviation of the velocities shall be not greater than 40 ft/s (12.2 m/s).

3.5.4.2 Velocity at extreme temperatures. The average velocity of cartridges conditioned at -65°F ± 2°F (-54°C ± 1.1°C) and at 125°F ± 2°F (52°C ± 1.1°C) shall not increase or decrease by more than 250 ft/s (76.2 m/s) with respect to the average velocity of cartridges conditioned at 70°F ± 2°F (21°C ± 1.1°C).

3.5.5 Action time. The average action time plus five standard deviations of cartridges conditioned at 70°F ± 2°F (21°C ± 1.1°C), -65°F ± 2°F (-54°C ± 1.1°C), and 125°F ± 2°F (52°C ± 1.1°C) shall be not greater than 3 ms.

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3.5.6 Cyclic rate. The cartridges shall function in the M4 Carbine at an average cyclic rate between 700 and 970 rounds per minute (rpm), in the M16A2 Rifle between 700 and 900 rpm, and in the M249 Machine Gun between 700 and 850 rpm when fired at 70ºF ± 2ºF (21°C ± 1.1°C).

3.5.7 Noise level. The noise level of the cartridges at the gunner's ear position shall be not greater than 164 decibels and the duration shall be not greater than 20 ms.

3.5.8 Bullet integrity. The bullet of the cartridge shall not burst or fragment in the barrel or in flight; neither shall the jacket of the bullet nor any part thereof strip from the other bullet components when the cartridge is fired.

3.5.9 Penetration. When fired at 0 degrees obliquity, the bullet of the cartridge shall be capable of the following penetration requirements:

Material and thickness	Range	Required penetration
3.5mm NATO plate	656 yds (600 m)	50%
12mm steel armor plate	109 yds (100 m)	100%
1/2 inch aluminum plate	492 yds (450 m)	50%
1/8 inch steel RHA plate	601 yds (550 m)	50%
Hollow concrete block (through both sides)	54.7 yds (50 m)	50%
1/4 inch steel RHA plate	437 yds (400 m)	50%
3/8 inch steel RHA plate	262 yds (240 m)	50%
1/2 inch steel RHA plate	164 yds (150 m)	50%

3.5.10 Accuracy/dispersion.

3.5.10.1 Dispersion. Both the average vertical standard deviation and the average horizontal standard deviation shall be no greater than 7.0 in (17.78 cm) at 600 yds (549 m).

3.5.10.2 Accuracy in weapons. The cartridge shall meet the accuracy requirement when fired in the following weapons:

3.5.10.2.1 M16A2 Rifle and M4 Carbine. A series of 10 rounds fired from each M16A2 Rifle or M4 Carbine at a range of 100 yds (91 m) shall be within the extreme spread and targeting area (heavy outline) specified in Figure 1 for the M16A2 Rifle and Figure 2 for the M4 Carbine.

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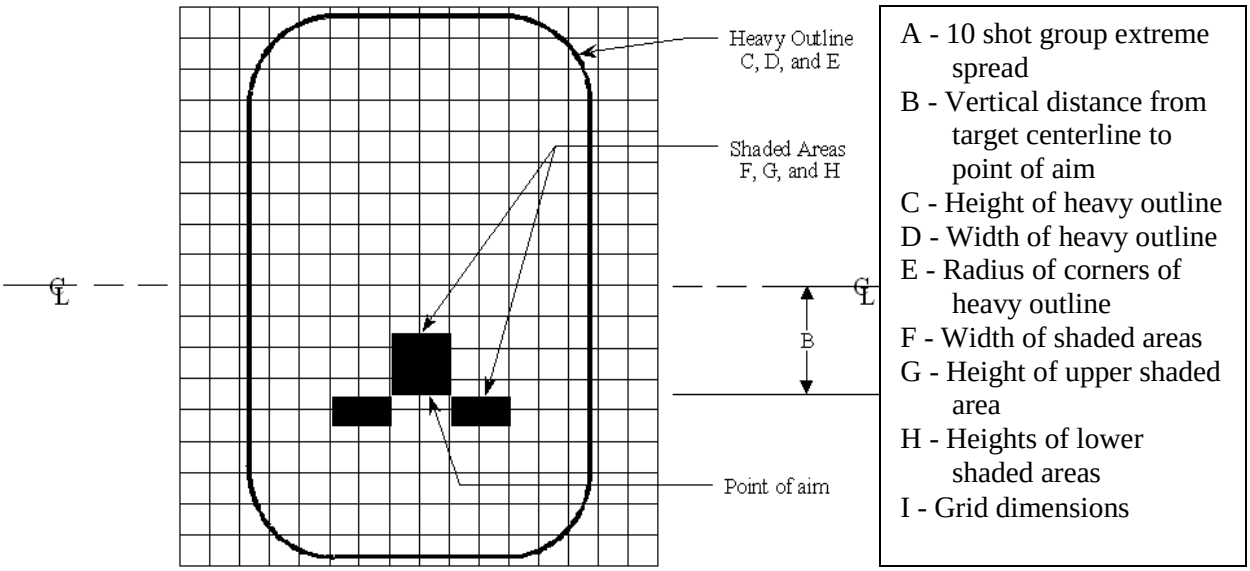
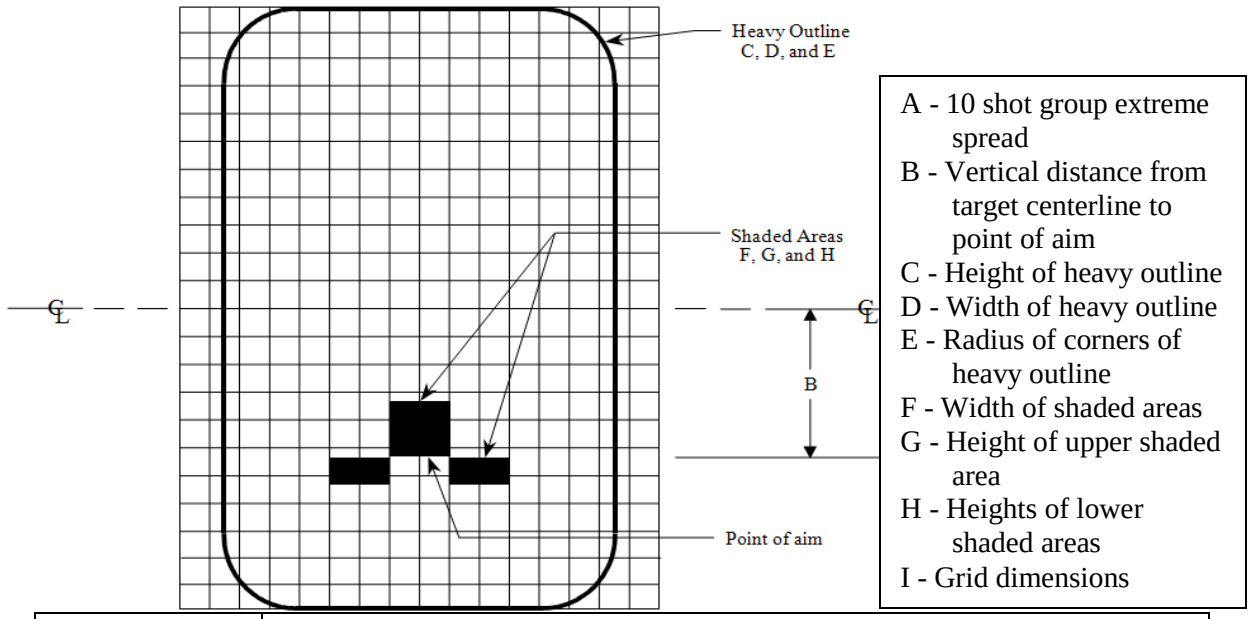

Heavy Outline
C, D, and E
Shaded Areas
F, G, and H
Point of aim
B
A - 10 shot group extreme spread
B - Vertical distance from target centerline to point of aim
C - Height of heavy outline
D - Width of heavy outline
E - Radius of corners of heavy outline
F - Width of shaded areas
G - Height of upper shaded area
H - Heights of lower shaded areas
I - Grid dimensions

Target Diagram For		Dimensions in Inches								
		Group	P.O.A	Heavy Outline			Shaded Areas			Grid
Meters	Yards	A	B	C	D	E	F	G	H	I
91.4	100	5.0	3.5	17.6	11.6	2.8	2.0	2.0	1.0	1.0

FIGURE 1. Targeting and accuracy diagram for M16A2 Rifle


Heavy Outline
C, D, and E
Shaded Areas
F, G, and H
Point of aim
B
A - 10 shot group extreme spread
B - Vertical distance from target centerline to point of aim
C - Height of heavy outline
D - Width of heavy outline
E - Radius of corners of heavy outline
F - Width of shaded areas
G - Height of upper shaded area
H - Heights of lower shaded areas
I - Grid dimensions

Target Diagram For		Dimensions in Inches								
		Group	P.O.A	Heavy Outline			Shaded Areas			Grid
Meters	Yards	A	B	C	D	E	F	G	H	I
91.4	100	5.6	5.2	22.0	13.2	2.9	2.0	2.0	1.0	1.0

FIGURE 2. Targeting and accuracy diagram for M4 Carbine

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3.5.10.2.2 M249 dispersion and targeting. When fired at a target located 54.7 yds (50 m) from the muzzle of an M249 Machine Gun, the following criteria shall be met:

3.5.10.2.2.1 Dispersion. Nine out of ten rounds fired in a single burst shall realize a figure of merit H+L (height + length) not greater than 13 in (33.02 cm). No key-holing shall be permitted.

3.5.10.2.2.2 Targeting. The mean point of impact of nine rounds of a ten round burst shall be within a 7.87 inch by 7.87 inch (20 cm by 20 cm) square. The center of this square shall be 1.97 inch ± 0.10 inch (5 cm ± 0.25 cm) above the point of aim.

3.5.11 Vertical trajectory. The trajectory of the projectile shall match within ± .75 mil of the M855 ball cartridge and the M856 tracer cartridge out to a range of 656 yds (600 m).

3.5.12 Bullet extraction. The force required to separate the bullet from the cartridge case shall be not less than 45 lbs (200 N).

3.5.13 Function and casualty.

3.5.13.1 Function and casualty for normal acceptance. The cartridge shall function without casualty throughout the temperature range from -65°F (-54°C) to 125°F (52°C) in the M4 Carbine, M16A2 Rifle, and the M249 Machine Gun.

3.5.13.2 Function and casualty at extreme temperatures. The cartridge shall safely function (none of the following defects: vent hole missing or obstructed, bullet remaining in bore, complete circumferential rupture, partial circumferential rupture in the K and L section, detached material, and uncontrolled fire of three rounds or greater) at -65°F ± 2°F (-54°C ± 1.1°C) and 155°F ± 2°F (68°C ± 1.1°C).

3.5.13.3 Function and casualty for design verification reliability. The reliability shall be comparable with the M855 cartridge: 0.999 reliability at 80% confidence.

3.5.14 Residual stress. The cartridge shall not have residual stresses that would cause it to crack or split.

3.5.15 Range safety fan. The range safety fan shall be established during design verification. All subsequent cartridges submitted for acceptance during first article and conformance testing shall meet this requirement.

3.5.16 Toxic fumes/heavy metals. The toxic fumes produced by the cartridge shall be comparable or less than those produced by firing similar quantities of 5.56mm, M855 ammunition. Personnel shall not be exposed to heavy metal levels in excess of the most stringent limits established by the Occupational Safety and Health Administration. The toxic fumes levels shall be within the acceptable levels established by the Surgeon General's Office.

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3.6 Environmental requirements.

3.6.1 Waterproofness. The cartridge shall be waterproof and tested against either requirement below:

a. Bubble test. The cartridge shall not release more than one bubble of air when subjected to a positive internal pressure of 7.5 pounds per square inch (psi) of water for not less than 30 seconds.

b. Firing test. After cartridges have been submerged in water at 70°F ± 2°F (21°C ± 1.1°C) for 24 hours (not less than 1 inch of water above the cartridges), and then fired, the cartridges shall have a mean velocity that does not vary by more than ± 50 ft/s (15.24 m/s) from the design velocity at 70°F ± 2°F (21°C ± 1.1°C).

3.6.2 Sequential rough handling. The cartridge shall be capable of withstanding the rigors of sequential rough handling and transportation found in the operational environment. The following tests must be performed in the specified sequential order:

a. transportation vibration (secured-cargo vibration)
b. 7 ft (2.1 m) packaged drop
c. loose cargo vibration
d. 5 ft (1.5 m) individual drop

3.6.3 Forty foot drop. When packaged in accordance with the packaging provisions of the contract, the cartridge shall not detonate or burn, lose propellant, and shall be safe to handle for disposal when subjected to the 40 ft (12.2 m) drop without injury to personnel.

3.6.4 Long term high temperature storage. The cartridge shall be safe to store and fire (no critical defects as defined in Table VI) after being subjected to 28 days of continuous heating at 140°F ± 2°F (60°C ± 1.1°C). The reliability (see 6.5.5) of the cartridge shall not degrade and the cyclic rate obtained during function and casualty shall not change by more than 15 percent.

3.6.5 Long term low temperature storage. The cartridge shall be safe to store and fire (no critical defects as defined in Table VI) after being subjected to 28 days continuous cooling at -40°F ± 2°F (-40°C ± 1.1°C). The reliability (see 6.5.5) of the cartridge shall not degrade and the cyclic rate obtained during function and casualty shall not change by more than 15 percent.

3.6.6 Thermal shock. The cartridge shall exhibit no evidence of corrosion and shall be safe to fire and function (no critical defects as defined in Table VI) after exposure to alternately high and low temperature extremes of 160°F ± 2°F (71°C ± 1.1°C) to -70°F ± 2°F (-57°C ± 1.1°C). The cyclic rate shall not change by more than 15% from the cyclic rate obtained during function and casualty.

3.6.7 Temperature and humidity cycling. The cartridge shall be safe to fire and function (no critical defects as defined in Table VI) after being subjected to a 10-day temperature/humidity cycle. The cyclic rate shall not change by more than 15% from the cyclic rate obtained during function and casualty.

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3.6.8 Corrosion (salt spray). The cartridge shall be safe to store and fire (no critical defects as defined in Table VI) after being subjected to a 5 percent salt spray (fog) for 48 hours.

3.6.9 Hot chamber effects (cook off). A cartridge inserted into the chamber of the M249 Machine Gun following the firing of 200 cartridges in the weapon shall not fire (cook off). A cartridge inserted into the chamber of the M4 Carbine and M16A2 Rifle following the firing of 150 cartridges in that weapon shall not fire (cook off). Following 15 minutes after the final cartridge has been fired, the cartridge shall not deform to the extent that clearing of the weapon is made difficult.

3.6.10 Electrostatic Discharge (ESD) personnel-borne. If cartridges are made with case material other than brass, then the cartridges shall withstand 25.0 ± 1.2 kilovolts electrostatic discharge without burning, exploding or becoming unsafe to handle. If cartridges are made with case material made of brass, testing for this requirement is not necessary.

3.6.11 Electrostatic Discharge (ESD) helicopter-borne. If cartridges are made with case material other than brass, then the cartridges shall withstand 300 ± 15 kilovolts electrostatic discharge without burning, exploding or becoming unsafe to handle. If cartridges are made with case material made of brass, testing for this requirement is not necessary.

3.6.12 Chemical compatibility. The cartridge shall maintain its function in the M4 Carbine, M16A2 Rifle, and the M249 Machine Gun after exposure to the following commonly encountered chemicals in the field

Material	Specification
Cleaning compound, solvent	MIL-PRF-372
Degreasing solvent (SD-1)	MIL-PRF-680, Type I
Lubricant, semi-fluid (automatic weapons)	MIL-L-46000
Lubricating oil, weapons, low temperature	MIL-PRF-14107
Lubricant (CLP)	MIL-PRF-63460
Decontaminating agent, STB	MIL-DTL-12468
Turbine fuel, aviation, kerosene types	MIL-DTL-83133
Standard specification for substitute ocean water	ASTM D1141
Water	Water (distilled)

3.6.13 Barrel erosion. Using M995 cartridges shall not reduce the average life of the M249 barrel to less than 15,000 rounds.

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3.7 Ownership and support requirements.

3.7.1 Final hazard classification (FHC). The M995 cartridge shall comply with the following hazard classification when packaged in accordance with packaging provisions of the contract or purchase order.

DOD Hazard Class/Div: _1.4_
DOD Hazard Compatibility Group: _S_
DOT Hazard Class: _1.4S_
Net Explosive Weight: _0.004 lbs (0.001830 kg)_

3.7.2 Energetic material qualification. All energetic materials used in the M995 cartridge shall be qualified for their intended military use by the Army Qualification Authority (see 6.8).

3.7.3 Energetic material compatibility. All energetic materials (explosives, propellants, and pyrotechnics) utilized shall be compatible with all combinations of directly contacting energetic and non-energetic materials. In addition, they shall be compatible with all combinations of materials that have the potential for contact in the system's life cycle (manufacturing environment and storage).

3.7.4 Propellant stability. All propellant shall be stable for not less than 20 years.

3.7.5 Explosive Ordnance Disposal (EOD). The cartridge shall be safe to handle, pickup, and transport by EOD personnel after a 20 minute wait period or after the application of EOD render safe procedures (see 6.4).

3.7.6 Ammunition lot numbering. Ammunition lot numbering shall be assigned in accordance with MIL-STD-1168.

3.7.7 Workmanship. The parts of the cartridge shall be free of cracks, splits, perforations, burrs, and foreign matter, as well as all other defects listed in Table V. The cleaning method used shall not be injurious to any parts, nor shall the parts be contaminated by any cleaning agent.

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4. VERIFICATION

TABLE I. Requirements/verification cross reference matrix

METHOD OF VERIFICATION 1 – Analysis 2 – Demonstration 3 – Examination 4 – Test						CLASSES OF VERIFICATION A – Design verification B – First article inspection C – Conformance inspection			
Section 3 Requirements		Verification Methods				Verification Class			Section 4 Verification Procedures
		1	2	3	4	A	B	C	
3.1	Design verification		X	X	X	X			4.1
3.1.1	Product uniformity		X	X	X	X	X	X	4.1.1
3.2	First article			X	X		X		4.2
3.3	Conformance verification		X	X	X			X	4.3
3.4.1	Interface with link				X	X	X	X	4.4.1
3.4.2	Physical dimensions			X	X	X	X	X	4.4.2, Table V
3.4.3	Head stamp				X	X	X	X	4.4.3, Table V
3.5.1	Primer sensitivity				X	X	X	X	4.5.1
3.5.2	Chamber pressure				X	X	X	X	4.5.2
3.5.3	Port pressure				X	X	X	X	4.5.3
3.5.4	Velocity				X	X	X	X	4.5.4
3.5.5	Action time				X	X	X	X	4.5.5
3.5.6	Cyclic rate				X	X			4.5.6
3.5.7	Noise level				X	X			4.5.7
3.5.8	Bullet integrity				X	X	X	X	4.5.8
3.5.9	Penetration: 3.5mm NATO plate				X	X	X	X	4.5.9
3.5.9	Penetration: 12mm steel armor plate				X	X	X	X	4.5.9
3.5.9	Penetration: 1/2 inch aluminum plate				X	X			4.5.9
3.5.9	Penetration: 1/8 inch steel RHA plate				X	X			4.5.9
3.5.9	Penetration: Hollow concrete block				X	X			4.5.9
3.5.9	Penetration: 1/4 inch steel RHA plate				X	X			4.5.9
3.5.9	Penetration: 3/8 inch steel RHA plate				X	X			4.5.9
3.5.9	Penetration: 1/2 inch steel RHA plate				X	X			4.5.9
3.5.10.1	Dispersion				X	X	X	X	4.5.10.1
3.5.10.2	Accuracy in weapons				X	X			4.5.10.2
3.5.11	Vertical trajectory				X	X			4.5.11
3.5.12	Bullet extraction				X	X	X	X	4.5.12
3.5.13.1	F&C for normal acceptance				X	X	X	X	4.5.13.1
3.5.13.2	F&C at extreme temperatures				X	X			4.5.13.2, 4.5.13.3
3.5.13.3	F&C for design verification reliability				X	X			4.5.13.4
3.5.14	Residual stress				X	X	X	X	4.5.14

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TABLE I. Requirements/verification cross reference matrix - continued

Section 3 Requirements		Verification Methods				Verification Class			Section 4 Verification Procedures
		1	2	3	4	A	B	C	
3.5.15	Range safety fan				X	X			4.5.15
3.5.16	Toxic fumes/heavy metals				X	X			4.5.16
3.6.1	Waterproofness				X	X	X	X	4.6.1
3.6.2	Sequential rough handling				X	X			4.6.2
3.6.3	Forty foot drop				X	X			4.6.3
3.6.4	Long term high temp storage				X	X			4.6.4
3.6.5	Long term low temp storage				X	X			4.6.5
3.6.6	Thermal shock				X	X			4.6.6
3.6.7	Temperature and humidity cycling				X	X			4.6.7
3.6.8	Corrosion (salt spray)				X	X			4.6.8
3.6.9	Hot chamber effects (cook off)				X	X			4.6.9
3.6.10	ESD personnel-borne				X	X			4.6.10
3.6.11	ESD helicopter-borne				X	X			4.6.11
3.6.12	Chemical compatibility				X	X			4.6.12
3.6.13	Barrel erosion				X	X			4.6.13
3.7.1	Final hazard classification				X	X			4.7.1
3.7.2	Energetic material qualification				X	X			4.7.2
3.7.3	Energetic material compatibility			X		X			4.7.3
3.7.4	Propellant stability				X	X			4.7.4
3.7.5	EOD				X	X			4.7.5
3.7.6	Ammunition lot numbering			X				X	4.7.6
3.7.7	Workmanship			X		X	X	X	4.7.7

4.1 Design verification. When specified, a sample of cartridges shall undergo design verification by analysis, demonstration, examination, and test in accordance with Tables I, II, V, and VI. The quantity of cartridges submitted for design verification shall be not less than 93,670 M995 rounds.

4.1.1 Key characteristics. Verify by examination of objective evidence and analysis that key characteristics have been identified and valid variability limits have been established.

4.1.2 Design verification rejection. If any item of the sample fails to comply with the design verification requirements, the design shall be rejected.

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TABLE II. Design verification tests and inspection

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
Product uniformity				3.1.1	4.1.1
Interface and interoperability				3.4	Table V
Examination for Defects	MIL-STD-1916			3.4, 3.7.7	Table V
Critical defects	100% & Level VII	0	1		
Major defects (101 to 104)	100%	0	1		
Major defects (105 to 121)	Level V	0	1		
Minor defects	Level III	0	1		
Primer sensitivity	600	1/, 6/		3.5.1	4.5.1
Chamber pressure, 3-test barrel		7/		3.5.2	4.5.2
-65°F	90	1/			
+70°F	90	1/			
+125°F	90	1/			
Port pressure, 3-test barrel		7/		3.5.3	4.5.3
-65°F	90	1/			
+70°F	90	1/			
+125°F	90	1/			
Velocity, 3-test barrel		7/		3.5.4	4.5.4
-65°F	90	1/			
+70°F	90	1/			
+125°F	90	1/			
Action time, 3-test barrel		7/		3.5.5	4.5.5
-65°F	90	1/			
+70°F	90	1/			
+125°F	90	1/			
Cyclic rate	3/			3.5.6	4.5.6
Noise level				3.5.7	4.5.7
(1 wpn) M4	20	1/			
(1 wpn) M16A2	20	1/			
(1 wpn) M249	20	1/			
Bullet integrity				3.5.8	4.5.8
M4	3/, 4/	1/			
M16A2	3/, 4/	1/			
M249	3/, 4/	1/			
Penetration				3.5.9	4.5.9
3.5mm NATO plate	30	15	16		
12mm steel armor plate	30	0	1		
1/2 inch aluminum plate	30	15	16		
1/8 inch steel RHA plate	30	15	16		
Hollow concrete block	30	15	16		

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TABLE II. Design verification tests and inspection – continued

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
Penetration (continued)				3.5.9	4.5.9
1/4 inch steel RHA plate	30	15	16		
3/8 inch steel RHA plate	30	15	16		
1/2 inch steel RHA plate	30	15	16		
Dispersion, +70°F					
1 test barrel	180	1/		3.5.10.1	4.5.10.1
(3 wpns) M4	180	1/		3.5.10.2.1	4.5.10.2
(3 wpns) M16A2	180	1/		3.5.10.2.1	4.5.10.2
(3 wpns) M249	180	1/		3.5.10.2.2	4.5.10.2
Vertical trajectory	100	1/		3.5.11	4.5.11
Bullet extraction	50	0	1	3.5.12	4.5.12
M4 Function and casualty		1/		3.5.13.1	4.5.13.1
(1 wpn) -65°F	200				Table VI
(1 wpn) +70°F	400				Table VI
(1 wpn) +125°F	200				Table VI
M16A2 Function and casualty		1/		3.5.13.1	4.5.13.1
(1 wpn) -65°F	200				Table VI
(1 wpn) +70°F	400				Table VI
(1 wpn) +125°F	200				Table VI
M249 Function and casualty		1/		3.5.13.1	4.5.13.1
(1 wpn) -65°F	200				Table VI
(1 wpn) +70°F	400				Table VI
(1 wpn) +125°F	200				Table VI
Function and casualty at extreme temperatures				3.5.13.2	Table VI
(3 wpns) +155°F, M4	3,000	1/			4.5.13.2
(3 wpns) +155°F, M16A2	3,000	1/			4.5.13.2
(3 wpns) +155°F, M249	3,000	1/			4.5.13.2
(3 wpns) -65°F, M4	3,000	1/			4.5.13.3
(3 wpns) -65°F, M16A2	3,000	1/			4.5.13.3
(3 wpns) -65°F, M249	3,000	1/			4.5.13.3
Function and casualty (reliability) at ambient temperature				3.5.13.3	Table VI 4.5.13.4
(3 wpns) M4	6,120	1/			
(3 wpns) M16A2	6,120	1/			
(3 wpns) M249	45,000	1/			
Residual stress	50	0	1	3.5.14	4.5.14
Range safety fan (test barrel)	450			3.5.15	4.5.15
Toxic fumes/heavy metals				3.5.16	4.5.16
(1 wpn) M4	150	5/			
(1 wpn) M16A2	150	5/			

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TABLE II. Design verification tests and inspection – continued

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
Toxic fumes/heavy metals (1 wpn) M249	500	5/		3.5.16	4.5.16
Waterproofness, +70°F	120	1/		3.6.1	4.6.1
Sequential rough handling (-62°F, +160°F)	3200 8/	2/		3.6.2	4.6.2
Forty foot drop (-62°F, +70°F, +160°F)	4800 8/	1/		3.6.3	4.6.3
Long term high temperature storage (28 day hot 140°F) (1 wpn) M16A2	250	1/		3.6.4	4.6.4
Long term low temperature storage (28 day cold -40°F) (1 wpn) M16A2	250	1/		3.6.5	4.6.5
Thermal shock (3 wpn) M16A2	600	1/		3.6.6	4.6.6
Temperature and humidity cycling (1 wpn) M16A2	200	1/		3.6.7	4.6.7
Corrosion (salt spray) (1 wpn) M4 (1wpn) M16A2 (1 wpn) M249	 120 120 200	 1/ 1/ 1/		3.6.8	4.6.8
Hot chamber effects (cook off) (1 wpn) M4 (1 wpn) M16A2 (1 wpn) M249	 750 750 1000	 1/ 1/ 1/		3.6.9	4.6.9
Electrostatic Discharge (ESD) at 73.4°F ± 18°F and RH ≤ 50% personnel-borne helicopter-borne	 20 10			 3.6.10 3.6.11	 4.6.10 4.6.11
Chemical compatibility (1 wpn) M16A2	300	1/		3.6.12	4.6.12
Barrel erosion (3 weapons) M249	45,000 3/			3.6.13	4.6.13
Final hazard classification				3.7.1	4.7.1
Energetic material qualification				3.7.2	4.7.2
Energetic material compatibility				3.7.3	4.7.3
Propellant stability				3.7.4	4.7.4
Explosive Ordnance Disposal		1/		3.7.5	4.7.5
Workmanship				3.7.7	4.7.8

NOTES:

1/ The design represented by the sample shall be rejected if it fails to comply with the applicable requirements.

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TABLE II. Design verification tests and inspection – continued

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
2/ If either M2A1 or M19A1 Ammunition box is used, then water resistance and pop tests shall not be required. 3/ This test shall be conducted simultaneously with function and casualty. 4/ The 300 round sample shall be composed of the following: a. One hundred rounds from the M249 function and casualty test. b. Sixty rounds from the M16A2 function and casualty test: 3 round burst mode. c. Forty rounds from the M16A2 function and casualty test: single shot mode. d. Sixty rounds from the M4 function and casualty test: 3 round burst mode. e. Forty rounds from the M4 function and casualty test: single shot mode. Failure of four or more bullets (from the total sample) to comply with the applicable requirements shall be cause for rejection of the lot. If more than one but less than four bullets fail in the first test, a second sample of 300 cartridges shall be tested in different M249, M4, and M16A2 weapons than were used in the first test. The lot shall be rejected if in the combined first and second sample, four or more bullets fail to comply with the applicable requirements. 5/ The design represented by the sample shall be rejected if it does not get approval from the Surgeon General's office. 6/ Fifty primers are tested at each height. If the average critical height plus 3 standard deviations is more than the all fire requirement or if the average critical height minus 3 standard deviations is less than the no fire requirement, a second test shall be run consisting of 100 primers at each height. Failure of the second sample to comply with the above criteria shall cause the lot to be rejected. 7/ These tests shall be conducted simultaneously. 8/ If the packaging configuration is not in accordance with Drawing No. 12590217, then the quantity of rounds tested shall be determined by the procuring activity.					

4.2 First article. When specified, a sample of the cartridges shall be subjected to first article verification by analysis, demonstration, examination, and test in accordance with Tables I, III, V, and VI. The quantity of cartridges submitted for first article shall be not less than 3,345 M995 rounds.

4.2.1 First article rejection. If any assembly, component or test specimen fails to comply with any of the applicable requirements, the first article sample shall be rejected.

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TABLE III. First article tests and inspection

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
Product uniformity				3.1.1	4.1.1
First article				3.2	4.2
Interface and interoperability				3.4	Table V
Examination for Defects	MIL-STD-1916			3.4, 3.7.7	Table V
Critical defects	100% & Level VII	0	1		
Major defects (101 to 104)	100%	0	1		
Major defects (105 to 121)	Level V	0	1		
Minor defects	Level III	0	1		
Primer sensitivity	600	1/, 4/		3.5.1	4.5.1
Chamber pressure		5/		3.5.2	4.5.2
-65°F	30	1/			
+70°F	30	1/			
+125°F	30	1/			
Port pressure		5/		3.5.3	4.5.3
-65°F	30	1/			
+70°F	30	1/			
+125°F	30	1/			
Velocity		5/		3.5.4	4.5.4
-65°F	30	1/			
+70°F	30	1/			
+125°F	30	1/			
Action time		5/		3.5.5	4.5.5
-65°F	30	1/			
+70°F	30	1/			
+125°F	30	1/			
Bullet integrity				3.5.8	4.5.8
M4	2/, 3/	1/			
M16A2	2/, 3/	1/			
M249	2/, 3/	1/			
Penetration				3.5.9	4.5.9
3.5mm NATO plate	20	10	11		
12mm steel armor plate	20	0	1		
Dispersion	90	1/		3.5.10.1	4.5.10.1
Bullet extraction	25	0	1	3.5.12	4.5.12
M4 Function and casualty				3.5.13.1	4.5.13.1
-65°F	200	1/			Table VI
+70°F	400	1/			Table VI
+125°F	200	1/			Table VI

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TABLE III. First article tests and inspection - continued

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
M16A2 Function and casualty				3.5.13.1	4.5.13.1
-65°F	200	1/			Table VI
+70°F	400	1/			Table VI
+125°F	200	1/			Table VI
M249 Function and casualty				3.5.13.1	4.5.13.1
-65°F	200	1/			Table VI
+70°F	400	1/			Table VI
+125°F	200	1/			Table VI
Residual stress	50	0	1	3.5.14	4.5.14
Waterproofness	50	1/		3.6.1	4.6.1
Workmanship				3.7.7	4.7.7

NOTES:

1/ The first article shall be rejected if it fails to comply with the applicable requirements.

2/ Conducted simultaneously with function and casualty.

3/ The 300 round sample shall be composed of the following:

a. One hundred rounds from the M249 function and casualty test.
b. Sixty rounds from the M16A2 function and casualty test: 3 round burst mode.
c. Forty rounds from the M16A2 function and casualty test: single shot mode.
d. Sixty rounds from the M4 function and casualty test: 3 round burst mode.
e. Forty rounds from the M4 function and casualty test: single shot mode.

Failure of four or more bullets (from the total sample) to comply with the applicable requirements shall be cause for rejection of the lot. If more than one but less than four bullets fail in the first test, a second sample of 300 cartridges shall be tested in different M249, M4, and M16A2 weapons than were used in the first test. The lot shall be rejected if in the combined first and second sample, four or more bullets fail to comply with the applicable requirements.

4/ Fifty primers are tested at each height. If the average critical height plus 3 standard deviations is more than the all fire requirement or if the average critical height minus 3 standard deviations is less than the no fire requirement, a second test shall be run consisting of 100 primers at each height. Failure of the second sample to comply with the above criteria shall cause the lot to be rejected.

5/ These tests shall be conducted simultaneously.

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4.3 Conformance verification. When specified, sample cartridges and components shall undergo conformance inspection by analysis, demonstration, examination, and tests as specified in Tables I, IV, V, and VI. The quantity of cartridges submitted for conformance verification shall be not less than 3,045 M995 rounds.

4.3.1 Lot formation. Lot formation shall conform to requirements of MIL-STD-1916. The cartridge lot shall contain:

a. Cartridge cases from one unchanged process and from one manufacturer.
b. Bullets from one unchanged process and one manufacturer.
c. Primers from one lot interfix number and one manufacturer.
d. Propellant from no more than two lot numbers and from one manufacturer.

4.3.2 Classifications of characteristics. Known character defects are classified in Table V. Inspection sampling requirements for critical, major, and minor characteristics are defined in MIL-STD-1916.

4.3.3 Conformance inspection rejection. If any item of the sample fails to comply with the conformance inspection requirements, the lot shall be rejected.

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TABLE IV. Conformance tests

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
Product uniformity				3.1.1	4.1.1
Interface and interoperability				3.4	Table V
Examination for Defects	MIL-STD-1916			3.4, 3.7.7	Table V
Critical defects	100% & Level VII	0	1		
Major defects (101 to 104)	100%	0	1		
Major defects (105 to 121)	Level IV	0	1		
Minor defects	Level II	0	1		
Primer sensitivity	300	4/		3.5.1	4.5.1
Chamber pressure		5/		3.5.2	4.5.2
-65°F	30				
+70°F	30				
+125°F	30				
Port pressure		5/		3.5.3	4.5.3
-65°F	30				
+70°F	30				
+125°F	30				
Velocity		5/		3.5.4	4.5.4
-65°F	30				
+70°F	30				
+125°F	30				
Action time		5/		3.5.5	4.5.5
-65°F	30				
+70°F	30				
+125°F	30				
Bullet integrity				3.5.8	4.5.8
M4	2/, 3/				
M16A2	2/, 3/				
M249	2/, 3/				
Penetration				3.5.9	4.5.9
3.5mm NATO plate	20	10	11		
12mm steel armor plate	20	0	1		
Dispersion	90			3.5.10.1	4.5.10.1
Bullet extraction	25			3.5.12	4.5.12
M4 Function and Casualty				3.5.13.1	4.5.13.1
+70°F	400	1/			Table VI
-65°F	200	1/			Table VI
+125°F	200	1/			Table VI

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TABLE IV. Conformance tests - continued

Examination or Test	Conformance Criteria			Requirement Paragraph	Inspection Method Reference
	Qty	Acc	Rej		
M16A2 Function and Casualty				3.5.13.1	4.5.13.1
+70°F	400	1/			Table VI
-65°F	200	1/			Table VI
+125°F	200	1/			Table VI
M249 Function and Casualty				3.5.13.1	4.5.13.1
+70°F	400	1/			Table VI
-65°F	200	1/			Table VI
+125°F	200	1/			Table VI
Residual stress	50			3.5.14	4.5.14
Waterproofness	50			3.6.1	4.6.1
Ammunition lot numbering				3.7.6	4.7.6
Workmanship				3.7.7	4.7.7

NOTES:

1/ The acceptance and retest numbers of Table VI shall be applied to the M249 results (all temperatures combined), the M16A2 results (all temperatures combined) and the M4 results (all temperatures combined) individually. All function and casualty defects observed in other ballistic tests shall be included in the defects count.

2/ Conducted simultaneously with function and casualty.

3/ The 300 round sample shall be composed of the following:

a. One hundred rounds from the M249 function and casualty test.
b. Sixty rounds from the M16A2 function and casualty test: 3 round burst mode.
c. Forty rounds from the M16A2 function and casualty test: single shot mode.
d. Sixty rounds from the M4 function and casualty test: 3 round burst mode.
e. Forty rounds from the M4 function and casualty test: single shot mode.

Failure of four or more bullets (from the total sample) to comply with the applicable requirements shall be cause for rejection of the lot. If more than one but less than four bullets fail in the first test, a second sample of 300 cartridges shall be tested in different M249, M4, and M16A2 weapons than were used in the first test. The lot shall be rejected if in the combined first and second sample, four or more bullets fail to comply with the applicable requirements.

4/ Twenty five primers are tested at each height. If the average critical height plus 3 standard deviations is more than the all fire requirement or if the average critical height minus 3 standard deviations is less than the no fire requirement, a second test shall be run consisting of 50 primers at each height. Failure of the second sample to comply with the above criteria shall cause the lot to be rejected.

5/ These tests shall be conducted simultaneously.

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TABLE V. Inspection by classification of characteristics

Classification	Examination or Test 1/	Conformance Criteria 3/	Requirement Paragraph	Inspection Method Reference
Critical				
1	Case split in K, L, or M location (6)	100% & Level VII	3.4.2	Visual/ Gage
2	Case split in S or J location with loss of powder (6)	100% & Level VII	3.4.2	Visual/ Gage
3	Perforated case (7)	100% & Level VII	3.4.2	Visual/ Gage
4	Propellant weight under minimum 2/	100% & Level VII	3.4.2	Gage
Major				
101	Primer missing (32)	100%	3.4.2	Visual/ Gage
102	Primer cocked (33)	100%	3.4.2	Visual/ Gage
103	Primer inverted (34)	100%	3.4.2	Visual/ Gage
104	Case split in I, S, or J location with no loss of powder	100%	3.4.2	Visual/ Gage
105	Corroded or stained (if etched) case (2)	Level IV	3.4.2	Visual
106	Round head (4)	Level IV	3.4.2	Visual
107	Dented case (5)	Level IV	3.4.2	Visual
108	Draw scratch in case (if applicable) (8)	Level IV	3.4.2	Visual
109	Beveled underside of head (10)	Level IV	3.4.2	Visual
110	Scaly metal on case (if applicable) (12)	Level IV	3.4.2	Visual
111	No chamfer on head (rim) (13)	Level IV	3.4.2	Visual
112	Loose primer (35)	Level IV	3.4.2	Visual/ Manual
113	Diameter of extractor groove, max, incorrect	Level IV	3.4.2	Gage
114	Diameter of head, incorrect	Level IV	3.4.2	Gage
115	Thickness of rim, incorrect	Level IV	3.4.2	Gage
116	Length of shoulder datum, incorrect	Level IV	3.4.2	Gage
117	Depth of primer, incorrect	Level IV	3.4.2	Gage
118	Primer cup missing	Level IV	3.4.2	Visual
119	Overall length, max, incorrect	Level IV	3.4.2	Gage
120	Cartridge identification marking missing/incorrect	Level IV	3.4.2	Visual
121	Profile and alignment, incorrect	Level IV	3.4.2	8648615

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TABLE V. Inspections by classification of characteristics - continued

Classification	Examination or Test 1/	Conformance Criteria 3/	Requirement Paragraph	Inspection Method Reference
Minor				
201	Discolored, dirty, oily or smeared waterproofing (1) (if applicable)	Level II	3.4.2	Visual
202	Dented case (5)	Level II	3.4.2	Visual
203	Draw scratch in case (8)	Level II	3.4.2	Visual
204	Scratch in case (9)	Level II	3.4.2	Visual
205	Scaly metal on case (12)	Level II	3.4.2	Visual
206	Fold, wrinkle, buckle or bulge in case (14, 15, 16, 17)	Level II	3.4.2	Visual
207	Head stamp missing or illegible (18)	Level II	3.4.3	Visual
208	Defective head (19)	Level II	3.4.2	Visual
209	No waterproofing material (if applicable) (primer pocket joint) (37)	Level II	3.4.2	Visual
210	Defective crimp (primer) (38)	Level II	3.4.2	Visual
211	Diameter of extractor groove, min, incorrect	Level II	3.4.2	Gage
212	Workmanship	Level II	3.7.7	Visual

NOTES:

1/ Numbers in parenthesis after defect descriptions refer to visual standards in MIL-STD-636.

2/ Prior to design verification testing, the minimum charge required to preclude the possibility of a bullet in bore shall be established. Cartridges containing less than this minimum charge are critically defective.

3/ Level II, Level IV, or Level VII refer to Verification Level II, Verification Level IV, or Verification Level VII respectively of Table II Attributes sampling plans in MIL-STD-1916.

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TABLE VI. Function and casualty firing defect criteria

Defect Description	Design Verification M16A2 & M4 (Individually)		Design Verification M249		First Article and Lot Acceptance	
	Acc	Rej	Acc	Rej	Acc	Rej
1. Bullet remaining in bore	0	1	0	1	0	1
2. Misfire 1/						
a. No vent hole, or obstruction in the vent area	0	1	0	1	0	1
b. Other	4	5	6	7	1	2
3. Primer leaks						
a. Perforation of firing pin indent in primer cup 6/						
(1) M249/FN Minimi Machine Gun	N/A		0	1	0	1
(2) M16A2 Rifle	0	1	N/A		0	1
b. Escape of gas through primer cup (excluding 3a above)	4	5	6	7	1	2
c. Escape of gas around primer cup						
(1) Total number allowed	59	60	120	121	12	13
(2) More than 50% of periphery	9	10	14	15	5	6
d. Blown primer - Primer separates from case head and primer pocket is grossly distorted.	0	1	0	1	0	1
e. Dropped primer - Primer falls out of pocket upon retraction of bolt.	1	2	1	2	0	1
f. Loose primer - Primer remains in pocket, but is physically loose.	1	2	1	2	0	1
4. Case casualties						
a. Longitudinal split 2/						
(1) Neck and shoulder (I or S)	20	21	25	26	6	7
(2) Body (J)	10	11	15	16	4	5
(3) Body (K)	1	2	1	2	0	1
(4) To head (L)	1	2	1	2	0	1
(5) Through head (M)	1	2	1	2	0	1
b. Circumferential rupture 2/						
(1) Partial, shoulder or body (J & S)	3	4	4	5	1	2
(2) Partial, body (K)	0	1	0	1	0	1
(3) Partial, head (L)	0	1	0	1	0	1
(4) Complete	0	1	0	1	0	1
5. Weapon stoppage 3/	1	2	1	2	0	1
6. Failure to extract	1	2	1	2	0	1
7. Detached material	1	2	1	2	0	1

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TABLE VI. Function and casualty firing defect criteria - continued

Defect Description	Design Verification M16A2 & M4 (Individually)		Design Verification M249		First Article and Lot Acceptance	
	Acc	Rej	Acc	Rej	Acc	Rej
8. Uncontrolled fire						
3 rounds or greater 4/	0	1	0	1	0	1
2 rounds or less 5/	0	1	0	1	0	1

NOTES:

1/ Each cartridge that misfires shall be disassembled and examined for presence of vent hole in primer pocket, or any obstruction in the vent hole area of the primer pocket that can be assignable as the cause for misfire. If the vent hole is missing or obstructed, the lot shall be rejected with no second sample permitted.

2/ For location of defects indicated by letters in parentheses, see Drawing No. 7643674.

3/ All stoppages attributable to the ammunition, with the exception of misfire, complete rupture or failure to extract, observed in all tests shall be included.

4/ Uncontrolled fire of 3 rounds or greater occurs when 3 or more rounds are fired in excess of that expected to be fired. For example, if in single shot mode, one trigger pull produces 4 or more rounds to fire, or in three round burst mode, one trigger pull causes 6 or more rounds to fire.

5/ Uncontrolled fire of 2 rounds or less occurs when 1 or 2 rounds are fired in excess of that expected to be fired. For example, if in single shot mode, one trigger pull produces 2 or 3 rounds to fire, or if in three round burst mode, one trigger pull produces 4 or 5 rounds to fire.

6/ For First Article or Lot Acceptance testing, if one or more perforated primer indent defects are found in the first sample, a second sample shall be fired in all 3 weapons (M4, M16, and M249). The second sample shall consist of double the quantity of cartridges specified under function and casualty on Table III or IV (First article tests and inspection or Conformance tests) for each weapon. Prior to the testing of the second sample, the firing pin of the specified weapon(s) in which the defect originally occurred shall be replaced with a new firing pin. If an additional primer perforation is found in the second sample, the first article or lot shall be rejected.

4.4 Interface and interoperability verification.

4.4.1 Interface with link. Interface and compatibility of the cartridges shall be verified by visual inspection, and observation during function and casualty firing tests.

4.4.2 Physical dimensions. The cartridge dimensions shall be verified by standard measurement equipment or specialty gauges.

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4.4.3 Head stamp. The stamp on the surface of the cartridge head shall be verified by visual inspection.

4.5 Operating verifications. All ballistic testing shall be examined against Table VI. For any ballistic test, except function and casualty, where the occurrence of a firing defect prevents the obtaining of a valid result for the characteristic being tested, the defect shall be observed. The particular test for which the round was fired shall not be penalized. A replacement round shall be fired to obtain the data for the test.

4.5.1 Primer sensitivity. Test in accordance with the SCATP-5.56mm (Heavy Bullet), Chapter 18, Primer Sensitivity, utilizing the ball and firing pin identified on Drawing Nos. 10520006 and 10524139, respectively.

4.5.2 Chamber pressure. The test samples shall be conditioned at the test temperatures, for not less than two hours. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 7, Electronic Pressure, Velocity and Action Time (EPVAT).

4.5.3 Port pressure. The test samples shall be conditioned at the test temperatures, for not less than two hours. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 7, Electronic Pressure, Velocity and Action Time (EPVAT).

4.5.4 Velocity. The test samples shall be conditioned at the test temperatures, for not less than two hours. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 7, Electronic Pressure, Velocity and Action Time (EPVAT).

4.5.5 Action time. The test samples shall be conditioned at the test temperatures, for not less than two hours. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 7, Electronic Pressure, Velocity and Action Time (EPVAT).

4.5.6 Cyclic rate. The cyclic rate shall be measured using a recorder capable of measuring to an accuracy of at least ± 2 percent. Cyclic rates shall be measured during function and casualty testing.

4.5.7 Noise level. The noise test shall be conducted in accordance with TOP 1-2-608, Impulse Noise Test, from one weapon of each type (M4 Carbine, M16A2 Rifle, and M249 Machine Gun). Testing shall be conducted in an area free of any sound-reflecting surfaces within 49 feet (14.9 m). For all test firings, the shooter shall fire from the prone position from the shoulder. Three microphones shall be placed:

a. 16.4 ft (5 m) to the rear of the weapon’s muzzle
b. 16.4 ft (5 m) to the left of the weapon
c. 16.4 ft (5 m) away 45° left/rear of the weapon’s muzzle

Simultaneous analysis of impulse noise levels shall be made at the three locations. In addition, evaluation of the impulse noise levels shall be made at the shooter's ear (left ear, weapon fired right-handed). With the exception of the shooter's ear position, all distances are from the weapon's muzzle. Five single shots of test ammunition and five rounds of standard M855 Ball ammunition shall be fired single shot.

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4.5.8 Bullet integrity. Test in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 6, Bullet Integrity. All irregular perforations shall be measured, and those greater than 1/10 inch shall be classed as defects.

4.5.9 Penetration. The penetration test shall be performed in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 13, Penetration, and the following materials:

a. 3.5mm NATO plate. The NATO plate shall be mild steel, 3.5mm nominal (10 gauge) thickness defined SAE (Society of Automotive Engineers) 1010 or SAE1020. The Rockwell hardness shall be not less than B55 and not greater than B70. The penetration test for the 3.5mm NATO plate shall only be performed when the temperature is above 20°F (-6.7°C).

b. 12mm steel armor plate. The Brinel hardness of the plate shall be not less than 300.

c. 1/2 inch aluminum plate. The aluminum used shall be a 5,000 series aluminum.

d. 1/8 inch steel RHA plate. The plate used shall be a 1/8 inch steel rolled homogeneous armor (RHA) plate (MIL-DTL-46177).

e. Hollow concrete block. The material used shall be a standard hollow concrete block. The block shall be checked for penetration through both sides.

f. 1/4 inch steel RHA plate. The plate used shall be a 1/4 inch steel rolled homogeneous armor (RHA) plate (MIL-DTL-12560).

g. 3/8 inch steel RHA plate. The plate used shall be a 3/8 inch steel rolled homogeneous armor (RHA) plate (MIL-DTL-12560).

h. 1/2 inch steel RHA plate. The plate used shall be a 1/2 inch steel rolled homogeneous armor (RHA) plate (MIL-DTL-12560).

4.5.10 Accuracy/dispersion.

4.5.10.1 Dispersion. The test shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 3, Accuracy.

4.5.10.2 Accuracy in weapons. The test shall be conducted as follows:

a. Dispersion and targeting in the M249 Machine Gun. This test shall be performed from a hard mount. Three weapons shall be used and six ten round targets shall be fired from each weapon. Ballistic zeroing shall be realized by adjusting the front sight. The rear sight shall be adjusted to the nominal position in both elevation and windage and set at the 328 yds (300 m) range setting. Five warming shots shall be fired prior to performing this test. Ten rounds of test ammunition shall be fired in a burst at a target located 54.7 yds (50 m) from the muzzle. The target shall be examined after firing to determine compliance with the requirement. The most unfavorable impact shall be deleted for the measurement of the extreme horizontal and vertical

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distances of the remaining nine shots. The same unfavorable impact shall be deleted when evaluating compliance with the targeting requirement.

b. Targeting and accuracy in the M16A2 Rifle. This test shall be performed using a firing stand simulating shoulder firing and targets in accordance with Figure 1. Three brand new weapons shall be used and six ten round targets shall be fired from each weapon. The front and rear sights are set as follows:

(1) The normal rear sight peep (sight rotated fully rearward) shall be used with the rear sight set centrally in the slot for windage within plus or minus five (5) clicks.

(2) The top edge of the front sight post flange shall be flush to 0.030 inch (0.076 cm) below the bottom surface of the front sight slot.

(3) The selector lever shall be set on "SEMI" and the firing sights shall be aligned on the point of aim specified in Figure 1.

Ten rounds shall be fired. The target shall then be checked to determine that the targeting and accuracy requirements have been met. Targets with evidence of a flyer or key-holing shall be cause for repeating the test.

c. Targeting and accuracy in the M4 Carbine. This test shall be performed using a firing stand simulating shoulder firing and targets in accordance with Figure 2. Three brand new weapons shall be used and six ten round targets shall be fired from each weapon. The front and rear sights are set as follows:

(1) The normal rear sight peep (sight rotated fully rearward) shall be used with the rear sight set centrally in the slot for windage within plus or minus five (5) clicks.

(2) The top edge of the front sight post flange shall be flush to 0.030 inch (0.076 cm) below the bottom surface of the front sight slot.

(3) The selector lever shall be set on "SEMI" and the firing sights shall be aligned on the point of aim specified in Figure 2.

Ten rounds shall be fired. The target shall then be checked to determine that the targeting and accuracy requirements have been met. Targets with evidence of a flyer or key-holing shall be cause for repeating the test.

4.5.11 Vertical trajectory. One hundred cartridges shall be tested in accordance with the procedures in TOPs 4-2-604 and 4-2-827. The test cartridges shall be fired from three 5.56mm accuracy barrels at an elevation of 15°. A radar system shall be positioned adjacent to the mount with the antenna aligned to the line of flight. The radar shall be capable of tracking the rounds for not less than 5 seconds. Data shall be measured no less frequently than every 27.3 yds (25 m). The test shall be repeated with standard M855 and M856 cartridges. Ballistic results of all 100 shots for each cartridge type shall be averaged and analyzed to determine the trajectory match with the service round at a range out to 656 yds (600 m). To be acceptable, the difference between the vertical trajectory of the M995 cartridge and the M856 and M856 cartridges shall be no more than .75 mil over the entire range.

4.5.12 Bullet extraction. The cartridge shall be tested in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 5, Bullet Extraction. The rate of travel of the test machine head shall be from 3 inches to 6 inches (7.62 cm to 15.24 cm) per minute.

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4.5.13 Function and casualty.

4.5.13.1 Function and casualty for normal acceptance. Function and casualty tests shall be conducted in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 10, Function and Casualty.

4.5.13.2 Function and casualty at high temperature. Three weapons of each type (M4, M16A2, and M249) and 1,000 rounds for each weapon shall be placed in a climatic-chamber facility and conditioned to 155ºF ± 2°F (68°C ± 1.1°C) for not less than four hours. The weapons shall be fired in 100 round cycles. Not less than two hour dwell time shall be observed between each cycle to allow the weapon to return to the conditioned temperature. Velocity and cyclic rate of fire shall be measured.

4.5.13.3 Function and casualty at low temperature. Three weapons of each type (M4, M16A2, and M249) and 1,000 rounds for each weapon shall be placed in a climatic-chamber facility and conditioned to -65ºF ± 2°F (-54°C ± 1.1°C) for not less than four hours. The weapons shall be fired in 100 round cycles. Not less than two hour dwell time shall be observed between each cycle to allow the weapon to return to the conditioned temperature. Velocity and cyclic rate of fire shall be measured.

4.5.13.4 Function and casualty for design verification reliability.

a. The reliability, function and casualty test shall be performed in accordance with TOP 3-2-045, and Chapters 4, Barrel Erosion, and 10, Function and Casualty, of SCATP-5.56mm (Heavy Bullet). Three Ml6A2 Rifles, three M4 Carbines, and three M249 Machine Guns shall be used to support this subtest. Prior to testing, each weapon shall be cleaned, inspected, and lubricated (CIL) with cleaner, lubricant, preservative (CLP) (MIL-PRF-63460).

b. M16A2 Rifle and M4 Carbine.

(1) Three each M16A2 Rifles and M4 Carbines shall each fire 2040 rounds of M995 AP ammunition in 120-round cycles. The weapons shall be lubricated at 600-round intervals and CIL at 1200-round intervals.

(2) The firings shall be accomplished in 17 cycles using 30-round magazines and fired in accordance with Table VII.

TABLE VII. Firing Cycle for M16A2 Rifle and M4 Carbine

Magazine No.	Firing Operation
1	Three-round burst every 5 to 8 seconds
2	Three-round burst every 2 to 5 seconds
3	Semiautomatic - 10 to 30 shots per minute (spm)
4	Semiautomatic - 10 to 30 spm

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(3) Four 30-round magazines for each weapon shall be numbered and used in rotation. The magazines shall be fully loaded for each use. Cyclic rate-of-fire for the weapons shall be measured during the second magazine of each cycle of the test. The cyclic rate-of-fire shall be measured on the fourth burst.

(4) The barrels of the weapons shall be forced air cooled after each cycle.

(5) One weapon shall be designated for function and casualty testing prior to the test. The first and last 120 cartridges (240 rounds total) fired from this weapon shall be visually inspected for defects listed in Table VI and Drawing No. 7643674.

c. M249 Machine Gun.

(1) The test shall consist of firing 45,000 rounds of linked ammunition from three weapons in 200-round cycles. The cartridges shall be linked using the M27 link (Drawing No. 11691287). 15,000 rounds shall be fired in each of three weapons. Prior to testing, the barrels assigned to each weapon shall be pneumatically gauged.

(2) The weapons shall be cleaned, inspected, and lubricated at 4000-round intervals and shall be re-lubricated at 2000-round intervals.

(3) For this subtest, the M249 SAW shall be fired from the bipod. The test firings shall be accomplished in 75 cycles using 200-round belts of test ammunition per barrel per cycle. The weapons shall be fired in bursts of 5 to 7 rounds at a rate of approximately 85 rpm. The barrels of the weapons shall be forced air cooled after every 200 rounds fired. Weapon cyclic rate-of-fire shall be measured prior to the initiation of the test and at every 2000-round interval and shall consist of a 20-round belt of M995 AP ammunition fired in one continuous burst.

(4) Muzzle velocity and yaw shall be measured prior to testing, at every 4000-round interval, and at the completion of testing and shall consist of a 20-round belt of M995 AP ammunition fired in one continuous burst. Muzzle velocity shall be measured using muzzle velocity radar equipment. Yaw shall be measured using a paper target located 27.3 yds (25 m) from the muzzle of the weapon.

(5) One weapon shall be designated for function and casualty testing prior to the test. The first and last 100 cartridges (200 rounds total) fired from this weapon shall be visually inspected for ammunition defects listed in Table VI and Drawing No. 7643674.

(6) There shall be no stoppages due to the interface between the cartridge and the M27 link.

4.5.14 Residual stress.

4.5.14.1 Cartridges with brass cases. Test in accordance with SCATP-5.56mm (Heavy Bullet), Chapter 12, Mercurous Nitrate. Prior to testing, all lubricants and coatings shall be

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removed from the cartridge case using solvents or cleaning techniques appropriate to the particular lubricant or coating being used.

4.5.14.2 Cartridges with polyethylene cases. Test in accordance with the following test procedure:

a. Immerse the test samples in the detergent. Seal the detergent coated samples in a polyethylene bag to minimize evaporation and place them in an aluminum tray. Place the tray with the sealed bags of test samples in an oven set at 160°F ± 5°F (71°C ± 2.8°C) for seven days.

b. After seven days, remove the tray from the oven and cool for one hour. Rinse the inert test samples in running water to remove the detergent. Dry with clean rags or paper towels. Coat the surfaces with machinist's dye and wipe with rags or towels, removing all excess dye from the surfaces.

c. Examine the surfaces for cracks, splits, and crazing using a 7-power eye loop or magnifying glass.

4.5.14.3 Cartridges with cases of other materials. Test in accordance with procedures appropriate to the material(s) used to manufacture the cartridge.

4.5.15 Range safety fan. The range safety fan test shall be conducted using a 5.56mm accuracy test barrel. Test firings shall be conducted against armor plate and sand at the 109.4 yd (100 m) range. The impact angles and number of data points for each media are shown in Table VIII below:

TABLE VIII. Surface danger zone test matrix

Impact Media		Impact Angle, deg				
		3	5	10	15	20
Armor Plate	Data Points	-	75	50	75	50
Sand	Data Points	25	50	50	25	50

The 5.56mm accuracy barrel shall be installed on a V-block recoil mechanism mounted to a Frankford Rest. The center of the accuracy barrel shall be aligned along the established LOF. A variable angle test table shall be positioned 109.4 yds (100 m) from the muzzle of the accuracy barrel (measurement made from muzzle to the trunnion of the table), perpendicular to the LOF. A Rolled Homogeneous Armor (RHA) plate shall be tack welded to the table with the center of the plate passing through the LOF and the trunnion. All positions shall be surveyed and the height of the accuracy barrel to the center of the trunnion of the variable table shall be measured to within 1 inch (2.54 cm).

A Ricochet Radar head or equivalent shall be used to measure the impact and exit velocities as well as the ricochet angles of the projectiles. The radar head shall be positioned

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appropriately to allow for maximum coverage of the expected ricochet cone. An IR detector shall be used to trigger the radar head.

All rounds shall be fired single shot from the accuracy barrel. An electronic theodolite shall be used to locate the impacts on the plate in relation to the radar position. A reflector shall be positioned on the impact point, and, with the theodolite aligned to the impact point, a laser range finder (LRF) shall be used to determine the position of the impact relative to the radar head. The drag and trajectory results, minimum impact and exit velocity, and the elevation and azimuth exit angle results shall be determined.

Testing shall be repeated using sand. The sand shall be Unimin's Accusand 20/30, unless otherwise specified. The moisture level and density of the sand shall be determined at the beginning of each day's firings.

4.5.16 Toxic fumes/heavy metals. The toxic fume and heavy metal test shall be conducted in accordance with TOP 2-2-614. Each M4 Carbine, M16A2 Rifle, and M249 Machine Gun shall be cleaned and lubricated prior to testing. The weapon to be fired shall be placed in a test fixture enclosed in a sealed toxic fumes chamber. All firing shall be done remotely. Five valid trials shall be obtained from each type of weapon. Each trial shall consist of 30 rounds of ammunition fired in 3 round bursts for the M4 Carbine and the M16A2 Rifle. Each trial for the M249 Machine Gun shall consist of 100 rounds fired in 10 round bursts. Toxic fumes levels shall be measured during and after the firing of the weapon until the concentrations have declined to an acceptable level. The emission of carbon monoxide (CO), ammonia (NH_3), sulfur dioxide (SO_2), and nitrous oxides (NO_x) shall be measured for each trial fired. The test chamber shall be cleaned of spent brass and vacuumed between trials. Testing shall be repeated using standard ammunition for comparison. The results of the toxic fume test shall be approved by the Surgeon General.

4.6 Environmental requirements.

4.6.1 Waterproofness. Verification for the waterproof requirement shall be performed by either of the following methods:

a. Bubble test. The bubble test shall be conducted in accordance with the SCATP-5.56mm (Heavy Bullet), Chapter 17, Waterproofness.

b. Firing test. A sample of cartridges shall be submerged for 24 hours in water at 70°F ± 2°F (21°C ± 1.1°C) in a horizontal position to a depth such that there is not less than one inch of water above the highest point of the cartridge. The cartridges shall then be removed from the water, wiped dry and placed in a temperature controlled room or chamber at 70°F ± 2°F (21°C ± 1.1°C) for not less than two hours. The velocity test shall then be conducted in accordance with the SCATP-5.56mm (Heavy Bullet). The average velocity of the cartridges shall be compared to the average velocity obtained from the velocity test of 4.5.4. The difference shall be less than 50 ft/s (15.24 m/s).

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4.6.2 Sequential rough handling. Prior to the start of the sequential rough handling tests, cartridges shall be packaged in a 5.56mm cartridge container. A total of 1600 M995 AP rounds shall be packaged in accordance with Drawing No. 12590217. Should another packaging configuration be used then the quantity of rounds tested and the test method shall be determined by the procuring activity. The sequential ruggedness testing consists of the following tests in order of occurrence: transportation-vibration (secured-cargo vibration), 7 foot packaged drop, loose-cargo vibration, and 5 foot individual drop. A sample of 400 test cartridges shall be withdrawn after each phase and fired from the M249 Machine Gun for function and casualty in accordance with SCATP-5.56mm (Heavy Bullet). The mean round between stoppages (MRBS) shall be determined by combining the rounds from all of the phases of the sequential rough handling test. A MRBS shall be determined for both rounds fired at high temperature and rounds fired at low temperature.

4.6.2.1 Transportation-vibration phase (secured-cargo). Testing shall be in accordance with ITOP 1-2-601. One wire-bound wooden wraparound box (1600 test cartridges) shall be temperature-conditioned at 160ºF ± 3ºF (71°C ± 1.7°C) for not less than 16 hours or until complete temperature soak prior to being subjected to secured-cargo vibration. A like number of cartridges shall be temperature conditioned at -62ºF ± 3ºF (-52°C ± 1.7°C) for not less than 16 hours prior to being subjected to secured-cargo vibration. The cartridges shall be reconditioned for not less than 16 hours between axes of vibration, except when two axes of vibration are conducted sequentially within the same day. When the latter occurs, the cartridges shall be moved directly from one test orientation to the next. The time the cartridges are out of temperature due to movement between the conditioning chamber and the test cell, as well as during the test setup, shall be regained in conditioning at a 1:1 ratio prior to the start of testing. The conditioning and vibration chamber temperatures shall be maintained within ± 3ºF (± 1.7°C) of the required test temperature. The 5.56mm cartridges shall be subjected to the secured-cargo vibration simulation in each of their three major orthogonal axes (vertical, transverse, and longitudinal). The vibration schedules used shall represent the secured-cargo transportation modes for a typical field/mission transport scenario over secondary and cross-country road surfaces as described in ITOP 1-2-601, Appendix B, Table B-1.

The first vibration schedule shall represent the vibration environment on the cargo bed of a composite of tactical vehicles consisting of the M127 12-ton semi trailer, M813 and M814 5-ton trucks, M36 2-1/2-ton truck, Commercial Utility Cargo Vehicle (CUCV) M1008 1-1/4-ton truck, the High-Mobility Multipurpose Wheeled Vehicle (HMMWV) M998 1-1/4-ton truck, and the Heavy Expanded Mobility Tactical Truck (HEMTT) M985 10-ton truck. This test shall represent 800 kilometers (km) of secured-cargo transport per axis.

The second vibration schedule shall represent the off-road conditions on the cargo bed of the 1/4-ton M416 and the 1-1/2-ton M105A2 two-wheeled trailer. The composite two wheeled trailer vibration environment shall simulate 15.5 miles (25 km) of secured-cargo transport per axis.

The third vibration schedule shall represent the environment on the cargo bed of the M548 tracked vehicle. This M548 tracked vehicle vibration environment represents 15.5 miles (25 km) of the transport per axis.

At the completion of each axis of vibration, the exterior surfaces of all containers shall be visually inspected for damage. For the final inspection (after all axes of all vibration), the SSCs shall be opened and the cartridges shall be visually inspected. Four hundred cartridges (one

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plastic ammunition magazine from each metal PA108 inner container) from each temperature shall be removed from the test sequence and subjected to function and casualty testing in accordance with SCATP-5.56mm (Heavy Bullet).

4.6.2.2 Seven foot packaged drop test. The 7 foot packaged drop test shall be conducted in accordance with ITOP 4-2-602, Appendix A. Twelve hundred test cartridges and 400 hundred dummy cartridges or an equivalent simulated dummy load shall be temperature-conditioned to 160ºF ± 3ºF (71°C ± 1.7°C) and a like number of cartridges temperature-conditioned to -62ºF ± 3ºF (-52°C ± 1.7°C) for not less than 16 hours or complete temperature soak prior to being drop tested. The cartridges shall be packaged in the 5.56mm packaging configuration (one per temperature).

At the completion of the preconditioning period, each container shall be subjected to two drops, one in each of the following impact orientations: (1) bottom down, (2) one side down. The drops shall be made from a quick-release hook attached to an overhead hoist at the prevailing outside air temperature. The test items shall be allowed to fall freely onto an armor plate, 3 inches (7.62 cm) thick, supported by 18 inches (45.72 cm) of crushed stone.

The containers shall be visually inspected after each drop for any damage. The containers shall then be opened and the 5.56mm cartridges shall be inspected for damage. Four hundred cartridges shall be removed from each temperature phase and shall be subjected to function and casualty testing in accordance with SCATP-5.56mm (Heavy Bullet). The remaining 800 test cartridges from each temperature environment shall be repacked in their respective containers and prepared for the loose-cargo (packaged) vibration test.

4.6.2.3 Loose-cargo (packaged) vibration. Testing shall be conducted in accordance with ITOP 4-2-602. The laboratory test shall represent 74.6 miles (120 km) of loose-cargo transport during off-road transport. The table shall be operated, shafts in phase, in a circular motion with a constant displacement of 1 inch (2.54 cm), double amplitude (DA), at a speed of 300 rpm, thus producing a table acceleration of 1.3 gravitational accelerations (g's). The packaged ammunition shall be tested for 15 minutes in each of two orientations: transverse and longitudinal. For the longitudinal axis, the packaged ammunition shall be placed on the table with the longitudinal axis of the test cartridges parallel to the transverse axis of the table surface. For the transverse axis, the packaged ammunition shall be placed on the table with the longitudinal axis of the cartridges parallel to the longitudinal axis of the table surface.

A wooden or hard solid retaining fence section shall be placed around the perimeter of a section of the bed of the package tester to prevent the ammunition containers from falling off the table and shall be positioned so that free space of approximately 1 inch (2.54 cm) exists on all sides of the SSCs. The loose cargo vibration testing shall be conducted at each of two temperatures: 160ºF ± 3ºF (71°C ± 1.7°C) and -62ºF ± 3ºF (-52°C ± 1.7°C). Eight hundred test cartridges and 800 dummy cartridges or an equivalent dummy load for each temperature environment shall be conditioned for not less than 16 hours or until a complete temperature soak prior to loose-cargo testing.

The containers shall be visually inspected after all vibration for any damage. The containers shall then be opened and the 5.56mm cartridges shall be inspected for damage. Four hundred cartridges shall be removed from each temperature phase and subjected to function and casualty testing in accordance with SCATP-5.56mm (Heavy Bullet). The remaining 400 test

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cartridges from each temperature environment shall be prepared for the five foot unpackaged drop test.

4.6.2.4 Five foot unpackaged drop. Testing shall be conducted in accordance with ITOP 4-2-602. At the completion of the reconditioning period, a random sample of 120 unlinked M995 AP test cartridges from each temperature environment shall be removed from their respective SSCs and subjected to the individual bare cartridge drops. The drop procedure, equipment, and impact surface shall be the same as previously described for the 7 foot drop test. Twenty cartridges from each temperature environment shall be dropped once in one of the following orientations: (1) nose down; (2) base down; (3) 45° nose down; (4) 45° base down; and (5) side down. In addition, 20 cartridges from each temperature environment shall be dropped once in each of the five orientations (multiple drops for each cartridge).

The cartridges shall be visually examined after each drop. The cartridges shall then be linked together and fired from the M249 Machine Gun for function and casualty testing in accordance with SCATP-5.56mm (Heavy Bullet).

4.6.3 Forty foot drop. The forty foot drop test shall be conducted in accordance with ITOP 4-2-601. Not less than three fully loaded containers shall be temperature conditioned for not less than 16 hours or until complete temperature soak at each of the following temperatures -62ºF ± 3ºF (-52°C ± 1.7°C), ambient, and 160ºF ± 3ºF (71°C ± 1.7°C), one container for each temperature.

Each container shall be subjected to a single 40 ft (12.2 m) drop in the normal shipping orientation. The drop shall be made from a quick-release hook attached to an overhead hoist and shall be made at the prevailing outside air temperature. The container shall be allowed to fall freely onto the impact surface. The container and test ammunition shall be visually inspected for damage and a determination made of suitability for safe handling and disposal. The criteria for acceptance shall be that the rounds are deemed safe to handle and disposed of following the test.

4.6.4 Long term high temperature storage. The cartridges shall be subjected to a 28 day continuous heating test. Two hundred fifty cartridges shall be placed in a climatic-chamber and conditioned to 140ºF ± 2°F (60°C ± 1.1°C) for 28 days. The cartridges are then inspected for any visual signs of deterioration. The cartridges are stored under standard ambient room temperature 70ºF (21ºC) for 48 hours. After that period, the ammunition shall be fired from an M16A2 Rifle in the 3 round burst mode. The cyclic rate of fire shall be compared to the cyclic rate of fire obtained during the function and casualty test. The cyclic rate shall be within 15 percent of the rate obtained during function and casualty. Failure of the rounds to safely function (none of the following defects: vent hole missing or obstructed, bullet remaining in bore, complete circumferential rupture, partial circumferential rupture in the K and L section, detached material, and uncontrolled fire of three rounds or greater) shall be cause for rejection.

4.6.5 Long term low temperature storage. The cartridges shall be subjected to a 28 day continuous cooling test. Two hundred fifty cartridges shall be placed in a climatic-chamber and conditioned to -40ºF ± 2°F (-40°C ± 1.1°C) for 28 days. The cartridges are then inspected for any visual signs of deterioration. The cartridges are stored under standard ambient room temperature 70ºF (21ºC) for 48 hours. After that period, the ammunition shall be fired from an M16A2 Rifle in the 3 round burst mode. The cyclic rate of fire shall be compared to the cyclic

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rate of fire obtained during the function and casualty test. The cyclic rate shall be within 15 percent of the rate obtained during function and casualty. Failure of the rounds to safely function (none of the following defects: vent hole missing or obstructed, bullet remaining in bore, complete circumferential rupture, partial circumferential rupture in the K and L section, detached material, and uncontrolled fire of three rounds or greater) shall be cause for rejection.

4.6.6 Thermal shock test. The thermal shock test shall be conducted in accordance with MIL-STD-810, Method 503.5, Temperature Shock. Six hundred test cartridges shall be subjected to thermal shock. The test samples shall be placed inside an environmental chamber set at -70°F ± 2°F (-57°C ± 1.1°C) for initiation of thermal shock test sequence. At the completion of the first 4 hour cycle, the cartridges shall be transferred to a high temperature chamber set at 160°F ± 2°F (71°C ± 1.1°C) for a 4 hour cycle. This process shall be repeated until 6 cycles (48 hours of exposure) are completed. The cartridges shall be visually inspected for any signs of deterioration. The cartridges shall then be stored under standard room temperature 70°F (21°C) for 48 hours. At the conclusion of the 48 hours storage, the sample cartridges shall be visually inspected for evidence of corrosion. The test cartridges shall then be function fired from an M16A2 Rifle in the 3 round burst mode. Two hundred cartridges shall be fired from each of three M16A2 Rifles. The cyclic rate of fire shall be compared to the cyclic rate of fire obtained during the function and casualty test. The cyclic rate shall be within 15 percent of the rate obtained during function and casualty.

4.6.7 Temperature and humidity cycling. Two hundred test cartridges are placed in the temperature-humidity chamber on a stainless steel, wire mesh rack. The chamber temperature and relative humidity (RH) are raised to 120ºF (48.9°C) and 30 ± 10 percent RH over a two hour period. This temperature- humidity environment is maintained for 24 hours, following which the chamber temperature is decreased to 70ºF (21°C) and RH is increased to 50 ± 10 percent, over a two hour duration. This temperature-humidity environment is maintained for 24 hours, following which the RH is raised to 95 ± 10 percent over a one hour period while maintaining a chamber temperature of 70ºF (21°C). The cartridges are then exposed to ten cycles (240 hours) of the temperature-humidity conditions given in TABLE IX below:

TABLE IX. Storage Schedule for 24-hour Humidity Test Cycle

Duration Phase	Temperature °F	Relative Humidity	Number of Hours
I	Gradually increase to 105° ± 3° and	90 ± 5	2
II	Maintain at 105° ± 3° and	90 ± 5	16
III	Gradually decrease to from 105° to 70° ± 2° and increase to 105°	95 ± 5	2
IV	Maintained at 105° ± 3° and	95 ± 5	4

After the third, fifth, eighth, and tenth cycles of the test, 50-round samples each of the ammunition are withdrawn from the chamber and visually inspected for any evidence of deterioration or corrosion. The cartridges shall then be fired from an M16A2 Rifle set in the 3 round burst mode. The cyclic rate of fire shall be compared to the cyclic rate of fire obtained during the function and casualty test. The cyclic rate shall be within 15 percent of the rate

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obtained during function and casualty. Failure of the rounds to safely function (none of the following defects: vent hole missing or obstructed, bullet remaining in bore, complete circumferential rupture, partial circumferential rupture in the K and L section, detached material, and uncontrolled fire of three rounds or greater) shall be cause for rejection.

4.6.8 Corrosion (salt spray). The sample shall be subjected to the salt-fog test outlined in Method 509.5, Salt Fog, of MIL-STD-810. After 48 hours of exposure to the 5 percent mixture, the sample shall be examined and its condition documented. Two hundred rounds shall then be loaded into links and fired from the M249 Machine Gun. One hundred twenty rounds shall be loaded into both the M4 Carbine and the M16A2 Rifle and fired in accordance with the firing sequence listed in Table VII. Failure of the rounds to safely function (none of the following defects: vent hole missing or obstructed, bullet remaining in bore, complete circumferential rupture, partial circumferential rupture in the K and L section (Drawing No. 7643674), detached material, and uncontrolled fire of three rounds or greater) shall be cause for rejection.

4.6.9 Hot chamber effects (cook off). Cookoff testing shall be conducted in accordance with TOP 3-2-045. The barrel of each weapon shall be instrumented to measure barrel temperatures in accordance with TOP 3-2-045. The weapon cyclic rate of fire, function performance, time to cookoff, ambient range temperature, and barrel temperature shall be measured for each trial. If cook off does not occur after 15 minutes, the cartridge shall be removed and the difficulty in its extraction shall be observed. The following procedure shall be followed for the individual weapons:

4.6.9.1 M4 and M16A2. Five trials for each type of weapon shall be used for this test. 150 rounds shall be fired in each weapon at the rate of 30 rounds every 10 seconds.

4.6.9.2 M249. Five trials with one weapon shall be used for this test. 200 rounds shall be fired in the weapon. The weapon shall be mounted in a test stand and fired using linked ammunition at a rate of 85 rounds per minute.

4.6.10 Electrostatic Discharge (ESD) personnel-borne. For non-brass cases, the tests shall be conducted in accordance with NAVSEAINST 8020.19 test procedures and test parameters. The tests shall be conducted at ambient temperature of 73.4°F ± 18°F (23°C ± 10°C) and relative humidity of ambient atmosphere shall be no greater than 50%. The test devices and ammunition shall be preconditioned for not less than 24 hours at temperature of 73.4°F ± 18°F (23°C ± 10°C) and relative humidity of ambient atmosphere no greater than 50%.

4.6.11 Electrostatic Discharge (ESD) helicopter-borne. For non-brass cases, the tests shall be conducted in accordance with NAVSEAINST 8020.19 test procedures and test parameters. The tests shall be conducted at ambient temperature of 73.4°F ± 18°F (23°C ± 10°C) and relative humidity of ambient atmosphere shall be no greater than 50%. The test devices and ammunition shall be preconditioned for not less than 24 hours at temperature of 73.4°F ± 18°F (23°C ± 10°C) and relative humidity of ambient atmosphere no greater than 50%.

4.6.12 Chemical compatibility. Test in accordance with the following procedure for cartridges consisting of other than a brass case and a copper jacketed bullet. A brass case and a

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copper jacketed bullet do not require any testing for verification.

a. 30 cartridges shall be immersed in each assigned chemical (see 3.6.12) for one hour at a depth of one inch (2.54 cm) above the case rim with the cartridge laid horizontally to the chemical. After one hour, the cartridges are removed, set base down in a storage rack and allowed to drain naturally for 24 hours.

b. After the 24-hour dripping period, the cartridges shall be wiped of the assigned chemical, and inspected for abnormalities.

The firing sequence shall be as follows: One hundred twenty rounds of control ammunition (M855 cartridges that were not exposed to any chemicals) shall be fired in an M16A2 Rifle. The 30 test sample cartridges from each required chemical, as designated in section 3, shall then be loaded into a 30 round magazine and fired in an M16A2 Rifle in the 3 round burst mode. If functioning problems are encountered with any of the test conditions, the weapon shall be inspected, cleaned, and an additional 120 rounds fired. The criteria shall be considered met if no safety problems are observed, and if there is not more than one stoppage in any 30 round group.

4.6.13 Barrel erosion. The test shall be conducted in accordance with Chapter 4, Barrel Erosion, of SCATP-5.56mm (Heavy Bullet) with the exception that the test shall be conducted for 15,000 rounds. Firing in any barrel shall be terminated when either the velocity drops 200 ft/s (60.96 m/s) or more or when the bullets from twenty percent or more of the cartridges in any burst show yaw greater than 15° at 83 ft (25.4 m) from the muzzle.

4.7 Ownership and support requirements.

4.7.1 Final hazard classification (FHC). FHC test shall be conducted in accordance with TB-700-2 during the Design Verification Test (DVT). The following UN test series, as defined in TB 700-2, shall be used: 6(a) for single package test, 6(b) for stack test, 6(c) for external fire test, 4(a) for thermal stability, and 4(b)(ii) for 12 meter drop test.

4.7.2 Energetic material qualification. Verify by examination of objective evidence that the Army Qualification Authority has qualified all energetic materials for their use (see 6.8).

4.7.3 Energetic material compatibility. Compatibility tests shall be conducted in accordance with Method 504.1.1, Reactivity Test, of MIL-STD-650 or Method 408.1.1, Reactivity Test (90 and 100°C), of MIL-STD-286. Compatibility is demonstrated when results reflect negligible reactivity.

4.7.4 Propellant stability.

4.7.4.1 Stability analysis. Propellant stabilizer analysis shall be conducted in accordance with Method 407.1, Surveillance Test (65.5°C), of MIL-STD-286. Propellant with stabilizer values of less than 0.30% shall not be used.

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4.7.4.2 Moisture and total volatiles. The test shall be performed two times using the oven method listed in MIL-STD-286, Method 101.2.2, Moisture and Volatiles (Oven Method). Propellant that does not meet manufacturing specifications for moisture and total volatiles shall not be used.

4.7.5 Explosive ordnance disposal (EOD). Verify by examination of objective evidence that the EOD has certified the cartridge.

4.7.6 Ammunition lot numbering. Visually verify that an ammunition lot number has been applied to each lot as described in MIL-STD-1168.

4.7.7 Workmanship. All test cartridges shall be examined for the defects listed in Table V. The criteria for grading defects shall be in accordance with MIL-STD-636.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DOD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The M995 Armor Piercing Cartridge is intended for use in the M4 Carbine, M16A2 Rifle, and the M249 Machine Gun. The armor piercing cartridges procured to this specification are military unique because there is no commercial market for armor piercing cartridges.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification, and of all reference documents cited in Section 2 and identified in Section 6 for information.

b. Requirements for submission of design verification sample when required (see 3.1).

c. Requirements for submission of first article sample when required (see 3.2).

d. Provision for submission of Inspection Equipment Designs and test equipment.

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e. Provisions for submission of acceptance inspection results for each lot of ammunition presented to the Government.

f. Packaging requirements. See 5.1 and applicable contract requirements. Packaging Drawing No. 12590217 has been qualified for the required hazard classification and is one method of packaging that may be used.

g. EOD test when required (see 3.7.5).

h. Information needed to satisfy the requirements for qualification of energetic materials by the Army Service Qualification Authority, see 6.8. This information can be obtained in the desktop guide titled Explosive Hazard Classification Requirements for Performance Specifications that is available from RDAR-QES-C.

i. Requirements for submission of ammunition data cards in accordance with MIL-STD-1168.

6.3 Contractor acceptance inspection equipment (AIE). Provisions concerning the AIE used to verify the requirements of this specification should be specified in the contract.

6.4 EOD qualification. EOD approval is conveyed by an EOD Supportability Statement. These configurations of the cartridges are required by EOD for evaluation: 90-degree inert cutaway models, complete inert cartridges, practice cartridges without main load/charge, and full-up cartridges (for disposal procedures). Point of contact for further information on EOD qualification can be obtained from Commander, US Army ARDEC, ATTN: RDAR-AEX, Picatinny Arsenal, NJ 07806-5000 (see 4.7.5).

6.5 Definitions.

6.5.1 Action time. Action time is defined as the sum of the primer ignition time, propellant burning time, and the time taken by the bullet to reach the gas port.

6.5.2 Interfix. A commodity made to one unchanged design which encompasses unchanged drawing(s), material(s) and specification(s), manufactured by a specific manufacturing process by a single manufacturer at a single location.

6.5.3 Key-holing. Key-holing is defined as any projectile yaw greater than 15 degrees.

6.5.4 Penetration. Penetration is defined as the passage of the penetrator through the target leaving a hole.

6.5.5 Reliability. For the purpose of this specification, the following measure of reliability should be used.

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$$\text{reliability} = 1 - \frac{\text{number of stoppages (ammunition related)}}{\text{number of rounds fired}}$$

6.6 Submission of alternative conformance provisions. All proposed alternative conformance provisions should be submitted to the Government for evaluation/approval as directed by the contracting activity.

6.7 Inspections to be performed. Lot testing requirements, if necessary, for explosive materials unique to the cartridge, should be provided by the ARDEC Safety Office through the contracting agency prior to contract award.

6.8 Energetic material qualification. Qualification of energetic materials by the Army Qualification Authority requires demonstration that the energetic material meets the requirements of AOP-7 or STANAG 4170. This task is addressed in the statement of work in the contract. Points of contact for the Army Qualification Authority can be obtained from Commander, US Army ARDEC, ATTN: RDAR-QES-C, Picatinny Arsenal, NJ 07806-5000.

6.9 Range safety fan. Data must be generated to develop the range safety fan for the cartridge (see 4.5.15).

6.10 Critical characteristic justification matrix. This matrix contains brief descriptions of the effects of critical defects the can occur in the M995 Armor Piercing Cartridge.

CRITICAL DEFECT	RATIONALE
Firing Defect: Bullet-in-bore	Firing the next round would result in an excessive amount of pressure build-up that could blow the receiver apart and cause injury to the shooter. The weapon could even experience disassembly from hot propellant gas and produce shrapnel. Blockage in the barrel could send hot gas out through the breech and into the users face. On most guns the bolt being closed after the shot will not completely seal off the gas. Gas could also vent out the back through the clearance between the bolt and the receiver. Some of this gas could also escape from the ejection port.
1.) Case split in K, L, or M location	Escape of hot propellant gases through breach could cause injury to shooters face or damage the weapon.
2.) Case split in S or J location w/ loss of powder	Split in this area wide enough to leak powder presents the risk of loss of sufficient energy to result in bullet-in-bore. Also, this can cause potential of friction ignition of loose powder in operating mechanism of weapon.
3.) Perforated or split case with propellant loss	Low propellant weight could cause a round to fail to exit the barrel resulting in a bullet-in-bore. This defect can also cause escaped hot propellant gases to return through the breach. It could cause weapon damage or injury to the shooter.
4.) Propellant weight under minimum	Low propellant weight could cause a round to fail to exit the barrel resulting in a bullet-in-bore.

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6.11 Subject term (key word) listing.

Bullet
Function and Casualty testing
Small Arms
Penetration

6.12 Changes from the previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodian:
Army-AR

Preparing activity:
Army-AR

(Project: 1305-2010-006)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil.